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the sun, and looking into the atmosphere very near it, solid particles in the air can be seen most plainly, and doing this at that place, the air seemed filled with grasshoppers in flight, myriads of them, extending high enough to appear as the finest specks, even with a field-glass. They certainly ranged some hundreds of feet above that summit in immense numbers. An occasional butterfly was seen also on the summit, but they were few.

Several species of flies are peculiarly abundant at 8,000 to 12,000 feet, which at times nearly set our animals frantic, but the most voracious kinds were troublesome only when the sun shone — even a passing cloud would drive them out of sight.

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## REVIEWS.

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THE GENESIS OF SPECIES.\* — Among the works called out by Darwin's epoch-making work, as the Germans happily style it, the present volume stands preëminent. It is a series of criticisms by a thorough evolutionist, and one who was originally a Darwinian. It will interest the general reader, the style being clear and attractive, and the spirit of the author thoroughly candid and calm. The author is well known in scientific circles by his original papers on the anatomy of certain of the vertebrates.

The object of the book is "to maintain the position that 'Natural Selection' acts, and indeed must act, but that still, in order that we may be able to account for the production of known kinds of animals and plants, it requires to be supplemented by the action of some other natural law or laws as yet undiscovered." Farther on he says "The view here advocated, on the other hand, regards the whole organic world as arising and going forward in one harmonious development similar to that which displays itself in the growth and action of each separate individual organism."

He thus sums up the difficulties against Darwinism, or the doctrine of "survival of the fittest" maintaining :—

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\* On the Genesis of Species. By St. George Mivart, F.R.S. London. Macmillan & Co. 1871. 12mo, pp. 296. With numerous wood cuts. \$2.00

"That 'Natural Selection' is incompetent to account for the incipient stages of useful structures.

"That it does not harmonize with the co-existence of closely similar structures of diverse origin.

"That there are grounds for thinking that specific differences may be developed suddenly instead of gradually.

"That the opinion that species have definite though very different limits to their variability is still tenable.

"That certain fossil transitional forms are absent which might have been expected to be present.

"That some facts of geographical distribution supplement other difficulties.

"That the objection drawn from the physiological difference between 'species' and 'races' still exists unrefuted.

"That there are many remarkable phenomena in organic forms upon which 'Natural Selection' throws no light whatever, but the explanations of which, if they could be attained, might throw light upon specific origination.

"Besides these objections to the sufficiency of 'Natural Selection' others may be brought against the hypothesis of 'Pangenesis,' which, 'professing as it does to explain great difficulties seems to do so by presenting others not less great — almost to be the explanation of *obscurum per obscurius*.'

These theses are the subjects of successive chapters in which they are maintained and defended with much acumen, and with many references to facts, easily comprehended by the general reader, but on which we have not room to dwell. In Chapter IV. on "Minute and Gradual Modifications," he refers to the conception of Mr. Galton in his work on "Hereditary Genius" that "new species have from time to time manifested themselves with suddenness, and by modifications appearing at once (as great in degree as are those which separate *Hipparrison* from *Equus*) the species remaining stable in the intervals of such modifications: by stable being meant that their variations only extend for a certain degree in various directions, like oscillations in a stable equilibrium."\*

Mr. Mivart gives among other examples of this sudden variation, the cases of young oysters, "which were taken from the shores of England and placed in the Mediterranean, and at once altered their mode of growth and formed prominent diverging rays, like those of the proper Mediterranean oyster; as also the twenty-nine kinds of American trees, all differing from their nearest

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\* Similar views were previously entertained by Messrs. Cope and Hyatt, as will be seen farther on.

European allies *similarly* — “leaves less toothed, buds and seeds smaller, fewer branchlets, etc.”

In his sixth chapter on “Species and Time” he maintains with much reason that “the mass of palaeontological evidence is indeed overwhelmingly against minute and gradual modification,” and that there is “no evidence of past existence of minutely intermediate forms when such might be expected *a priori*.” “All the most marked groups, bats, pterodactyls, chelonians, ichthyosauria, anura, etc., appear at once upon the scene. Even the horse, the animal whose pedigree has been probably best preserved, affords no conclusive evidence of specific origin by infinitesimal, fortuitous variations; while some forms, as the labyrinthodonts and trilobites, which seemed to exhibit gradual change, are shown by further investigations to do nothing of the sort.” “Now all these difficulties [of time, and the absence or rarity of fossils in the oldest rocks, etc., etc.,] are avoided if we admit that new forms of animal life of all degrees of complexity appear from time to time with comparative suddenness, being evolved according to laws, in part depending on surrounding conditions, in part internal — similar to the way in which crystals (and, perhaps from recent researches, the lowest forms of life) build themselves up according to the internal laws of their component substance, and in harmony and correspondence with all environing influences and conditions.” The latter clause is unnecessarily vague, substitute embryological laws, or changes (for the differences between species, and especially genera, arise in all probability for the most part during the growth of the embryo), and we would agree with the author’s meaning.

This is as far as the treatise goes, the author’s aim being simply to show that “species have been evolved by ordinary *natural laws* (for the most part unknown) controlled by the *subordinate* action of ‘Natural Selection,’ ” acting with the Divine concurrence.

What are these natural laws? The author has evidently overlooked the writings of certain naturalists in this country, who have endeavored to show that Natural Selection is insufficient to account for the origin of generic and specific forms. Professor E. D. Cope in his “Origin of Genera”\* has attempted to show, and we think with much success, that genera are produced by the ac-

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\* Proceedings of the Academy of Natural Science, Philadelphia, 1868.

celeration and retardation of certain parts of the animal, during its growth, and Professor Hyatt previously\* showed that the development of the individual Cephalopod is an epitome of the development of the cephalopods generally, and that the successive forms were produced with comparative suddenness.

Previous to the appearance of Mivart's work in this country the reviewer, in the present journal (vol. iv, p. 755), while remarking on the ancestry of the King Crab, Trilobites and other Branchiopoda, accounted for their origin rather by a process of acceleration and retardation, involving a more or less sudden formation of generic forms, than by the theory of Natural Selection, and offered several of the objections against Darwinism which appear in the work under review. The former law, probably in active operation during the earlier portion of embryonic life, accounts for the origin of the differences, while Mr. Darwin simply assumes an inherent tendency to variation. Cope's law may account for the *origin* of the new forms, while Natural Selection apparently plays an entirely subordinate role, and even may be found to account merely for the *preservation* (as suggested by the Duke of Argyll) of the specific form, keeping it within limits by the survival of the fittest, and the lopping off of monstrosities and by the checking of all tendencies to variation in a useless direction.

MEDICAL MICROSCOPY.† — Dr. Richardson's book is an experiment in an absolutely unoccupied field. Other works of somewhat similar nature are books for microscopists who are physicians; this is a book for physicians who are not microscopists. Meagre in its account of apparatus and inaccurate in its scholarship as it must be confessed to be, it is an earnest, straightforward and successful attempt to enable the practicing physician to make the microscope useful in his daily work. Some who use it for this purpose will be disappointed, for successful microscopical work requires a delicate tact and a mechanical ingenuity which are possessed by very few persons, and which are wanting to many even among physicians. Good microscopists, too, are developed, not made;

\* Parallelism between the order and individual in the Tetrabranchiate Cephalopods. Memoirs of the Boston Society of Natural History, 1866, and AMERICAN NATURALIST. Vol. IV, pp. 230 and 419.

† A Hand-Book of Medical Microscopy. By Joseph G. Richardson, M. D., Microscopist to the Pennsylvania Hospital. 12mo, pp. 333. Philadelphia: J. B. Lippincott & Co., 1871. [This review was prepared for a previous number, but its appearance was accidentally delayed.—EDS.]